CRADA facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

COMBUSTION
PROJECT

COMBUSTION AND ENVIRONMENTAL RESEARCH FACILITY

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Capabilities

The Federal Energy Technology Center conducts pilot-scale evaluations in the Combustion and Environmental Research Facility (CERF) to enhance fuel, emissions, and/or efficiency performance in pulverized-coal combustors. Technical issues include fuel handling, combustibility, ash deposition, and flue gas emissions. Commissioned in 1989, the basic CERF design criteria achieves similarity with utility boilers to replicate typical specification ranges for burner relative-mass-flow, temperature distribution, gas residence time, and convective-section gas velocity. Although pilot-scale combustors cannot exactly duplicate conditions in utility boilers because of inherent distortions, such as heat release rates and surface-to-volume ratios, they are useful to examine the integrated effects of various interdependent design/operating variables. Fuel quality is assessed by comparing pilot-scale performance with that of reference fuels for which full-scale performance is known. The CERF operates round-the-clock for continuous periods of one to three weeks, and is equipped to evaluate the following fuel characteristics:

- Transport, handling, and storage.
- Combustibility, including flame stability and carbon conversion efficiency.
- Ash deposition and removal characteristics (e.g., soot-blowing requirements).
- Flue gas emissions, such as SO_2, NO_X, CO, and particulates.

Over 20 coals have been tested in the CERF, including run-of-mine, conventionally washed, and deep-cleaned coals, as well as coal blends. The flexible design of the CERF has facilitated the development/testing of various systems and concepts to improve combustion and reduce pollution. Projects have included evaluation of:

- In-furnace low-NO_X combustion concepts for gas and coal firing.
- Post-combustion flue gas cleanup technologies to reduce SO_2 and NO_X.
- Advanced diagnostic instrumentation for study of combustion processes.

Current CERF testing involves evaluating biomass co-firing, including various wastes (e.g., sawdust) and energy crops, such as switchgrass and hybrid willow. The emphasis is on biomass fuel processing and determining practical limits for particle size and moisture content, as well as evaluating impacts such as carbon burnout, ash deposition, and emissions when co-firing biomass at 5 to 30 percent on an energy basis. Ceramic and advanced alloy materials are also being evaluated to determine practical upper temperature limits and for applications in high-temperature, air-based heat exchangers and slag screens. The CERF allows materials scientists to expose well-characterized samples under realistic combustion conditions.

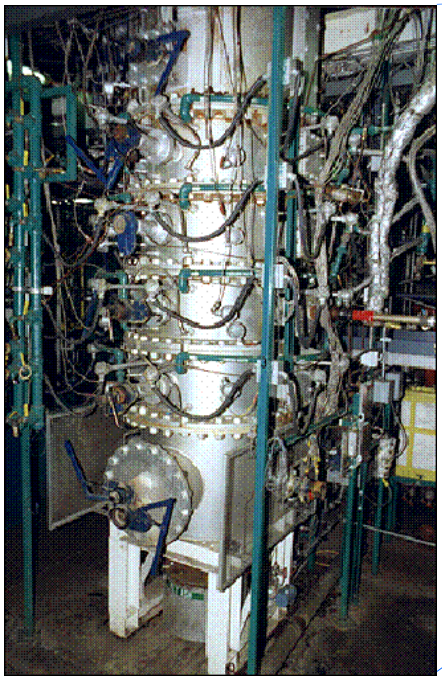
COMBUSTION AND ENVIRONMENTAL RESEARCH FACILITY

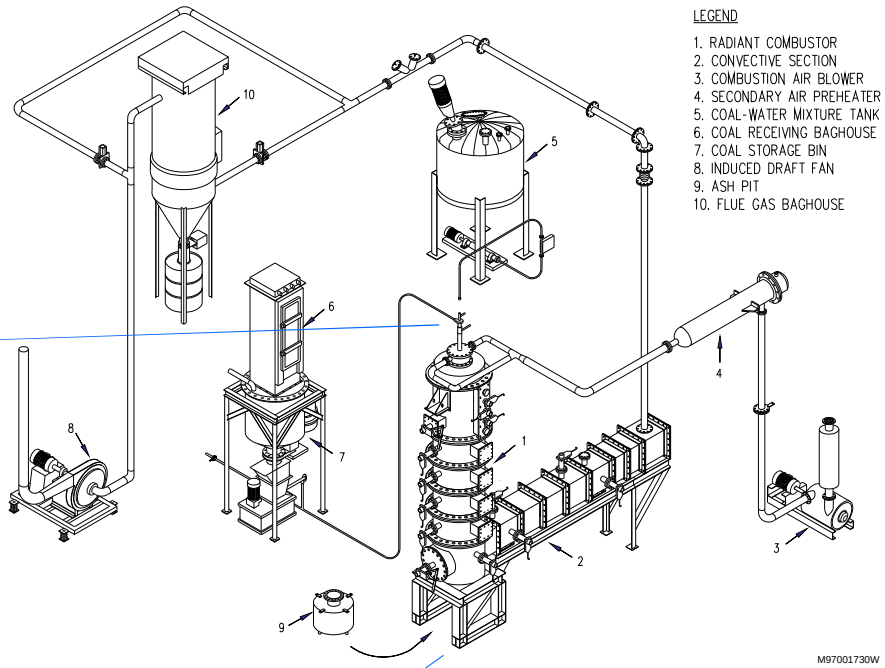
Opportunities

The CERF has been used in five CRADAs, which allow industry to access federal research facilities through in-kind and other arrangements. These CRADAs have involved coal quality studies and in-furnace NO_x reduction processes that were consistent with FETC program goals.

Activities have also been funded by other government agencies. For example, a U.S. Agency for International Development (USAID) study for the Ukraine, India, and Indonesia included combustion tests on foreign run-of-mine and cleaned coals (using U.S. technology) as well as providing engineering design, review work, and training for visiting scientists and engineers.

Much of the CERF activities involve interaction with outside parties that bring their fuels, concepts, equipment, and/or high-temperature materials for evaluation under realistic coal-combustion conditions. Typically, the CERF objective is to provide a test bed for ideas that are at laboratory scale, and to obtain basic information that could support large-scale proof-of-concept testing or a full-scale utility test burn.





The pilot-scale CERF is designed to test solid, liquid, and gaseous fuels used in utility power plants.

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